

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 1 142 935 A2**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
10.10.2001 Bulletin 2001/41

(51) Int Cl.7: **C08J 5/12, C09J 123/06**  
// B60K15/01

(21) Application number: **01108729.3**

(22) Date of filing: **06.04.2001**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU**  
**MC NL PT SE TR**  
Designated Extension States:  
**AL LT LV MK RO SI**

(30) Priority: **07.04.2000 JP 2000106957**

(71) Applicant: **Kyosan Denki Co., Ltd.**  
**Sashima-gun, Ibaraki-pref., 306-0206 (JP)**

(72) Inventors:  
• **Muto, Nobuharu**  
**Sowa-machi, Sashima-gun, Ibaraki-pref306 (JP)**  
• **Osaki, Hiroshi**  
**Sowa-machi, Sashima-gun, Ibaraki-pref306 (JP)**

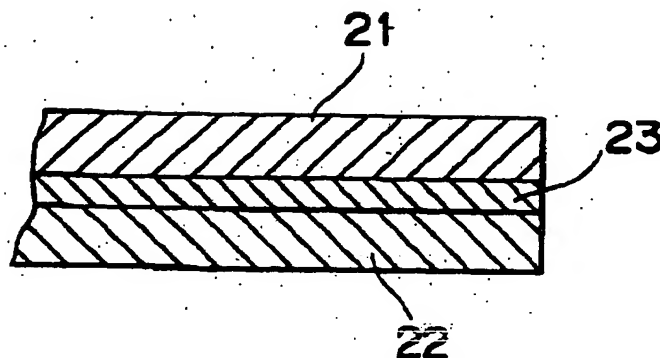
(74) Representative:  
**Winter, Brandl, Fürniss, Hübner, Röss, Kaiser,**  
**Polte Partnerschaft**  
**Patent- und Rechtsanwaltskanzlei**  
**Alois-Steinecker-Strasse 22**  
**85354 Freising (DE)**

(54) **Plastic parts joining structure**

(57) In a structure for joining a first plastic part and a second plastic part, the first plastic part (21) is composed of at least one resin such as polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide

(PPS), while the second plastic part (22) is composed of high-density polyethylene (HDPE). Between the two parts (21, 22), a metamorphic polyethylene layer (23) exhibiting a good joining property for both the first and second plastic parts (21, 22) is interposed to join the parts.

**FIG. 1B**



EP 1 142 935 A2

**Best Available Copy**

## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the invention

[0001] The invention relates to a structure for joining thermoplastic resin parts to each other.

#### 2. Description of Related Art

[0002] In a fuel supply system of an automobile, making various parts out of plastic has been proposed for weight reduction. Since within a fuel supply system a fuel tank is a relatively large part, the use of plastic for this part largely contributes to weight reduction of the vehicle. Thus, in recent years, many different plastic fuel tanks have been implemented.

[0003] When a plastic fuel tank is used, it is difficult to mount different members such as a fuel cut valve and onboard refueling vapor recovery (ORVR) valve to be connected to the fuel tank. When joining plastic parts, fusing is normally employed, but joining by fusing can be difficult depending on the type of resin, making it difficult to improve airtightness or prevent the member from coming off.

[0004] For example, Japanese Patent Application Laid-Open Publication No. HEI 10-71861 discloses related art which is a mounting structure for a fuel cutoff valve to a plastic fuel tank. The mounting structure of the related art is described hereafter with reference to Fig. 6.

[0005] A skin layer of a fuel tank 1 is composed of high-density polyethylene (HDPE) from the viewpoint of strength and durability. On the other hand, a fuel cutoff valve 2 is composed of polyacetal (POM). The difference in materials employed for the fuel tank 1 and the fuel cutoff valve 2 leads to problems in fusing due to the difference in melting points of the respective materials. Consequently, joining the members stably for an extended period of time is difficult.

[0006] To solve this problem, in this structure, the fuel cutoff valve 2 is joined to a high-density polyethylene (HDPE) fuel cutoff valve mounting member 3 by insert molding (joining) first, and then the fuel cutoff valve mounting member 3 in which the fuel cutoff valve 2 is insert-molded is joined to the fuel tank 1.

[0007] As another example, Japanese Patent No. 2715870 discloses another related art which is a pipe joining structure which is described with reference to Fig. 7.

[0008] A pipe 11 on one side is composed of high-density polyethylene (HDPE) corresponding to the material of a tank. On the other hand, a pipe 12 on another side is composed of polyamide (PA). This polyamide resin does not exhibit a good joining property with high-density polyethylene so it is difficult to fuse these materials directly.

[0009] Therefore, the pipe 11 on the one side composed of high-density polyethylene (HDPE) is insert molded (joined) with the portion 13 of the pipe 12 on the other side.

[0010] According to the aforementioned related arts for a joining structure for plastic parts; however, there have been problems such as the following.

[0011] First, a resin such as high-density polyethylene (HDPE) does not exhibit an excellent joining property with other resins such as polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide (PPS) so it is difficult to maintain a joined state and airtightness over an extended period of time.

### SUMMARY OF THE INVENTION

[0012] Therefore, it is an object of the invention to provide a joining structure in which the joining structure of plastic parts is improved so that the joined state is maintained as well as airtightness for an extended period of time.

[0013] In order to achieve the aforementioned object, a joining structure as a first aspect of the present invention includes a first plastic part composed of at least one thermoplastic resin of polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide (PPS), a second plastic part composed of at least high-density polyethylene (HDPE), and a metamorphic polyethylene layer that comes in contact with both the first plastic part and the second plastic part for joining the first plastic part and the second plastic part.

[0014] The joining property between such a resin as high-density polyethylene (HDPE) and other resins including polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide (PPS) is not particularly good. However, a joined state and airtightness can be maintained stably for an extended period of time by joining the two members with a metamorphic polyethylene that exhibits an excellent joining property with both of the members.

### BRIEF DESCRIPTION OF THE DRAWINGS

#### [0015]

Fig. 1 is a schematic drawing of the joining structure according to the present invention;

Fig. 2 is a sectional view showing a structure of an embodiment of the present invention, in which a plastic fuel cut valve is joined to a plastic fuel tank. Figs. 3A and 3B are sectional views showing a structure for preventing the valve from coming off at the joined portion according to the present invention.

Fig. 4 is a sectional view showing an indexing mech-

anism at the joined portion according to the present invention.

Fig. 5 is a sectional view showing an structure that improves airtightness of the joined portion according to the present invention.

Fig. 6 is a sectional view showing the joined state of a plastic fuel tank and a fuel cut valve as a related art of the present invention.

Fig. 7 is a sectional view showing the joined state of plastic pipes as another related art of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Embodiments of the present invention will hereinafter be described.

[0017] Referring to Fig. 1, the joining structure of plastic parts according to the present invention, as well as the structure according to related art will be described schematically.

[0018] As shown in Fig. 1A, in the joining structure of plastic parts according to the related art, a first plastic part 21 is composed of at least one of polyamide (PA) or polyacetal (POM), and a second plastic part 22 is composed of high-density polyethylene (HDPE). Furthermore, both parts 21 and 22 are joined by insert molding or the like.

[0019] On the other hand, in the joining structure of the present invention as shown in Fig. 1B, the first plastic part 21 is composed of at least one of polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide (PPS), while the second plastic part 22 is composed of high-density polyethylene (HDPE). In addition, a joining layer composed of the metamorphic polyethylene layer 23 is interposed between both parts 21 and 22.

[0020] According to the present invention, reliable joining is obtained with a good joining property with polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide (PPS) composing the first plastic part 21 and the metamorphic polyethylene layer 23.

[0021] Reliable joining is obtained also with a good joining property with high-density polyethylene (HDPE) composing the second plastic part 22 and the metamorphic polyethylene layer 23.

[0022] Referring to Fig. 2, another embodiment will hereinafter be described in which a plastic member is mounted to a plastic fuel tank.

[0023] A skin layer of a fuel tank 31 is composed of high-density polyethylene (HDPE), while a fuel cut valve is composed of polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide (PPS).

[0024] The fuel cut valve 32 is formed with a flange portion 32A to which a metamorphic polyethylene layer 33 is joined. In this case, with a good joining property

between polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide (PPS) and the metamorphic polyethylene layer 33, a joined state is maintained stably for an extended period of time and airtightness is also maintained.

[0025] In addition, the fuel tank 31 is formed with a mounting portion 31A which is composed of high-density polyethylene (HDPE) just as is the fuel tank 31.

[0026] The metamorphic polyethylene layer 33 is joined to the mounting portion 31A. In this case, with good joining properties for high-density polyethylene (HDPE) and the metamorphic polyethylene, a joined state is maintained stably for an extended period of time and airtightness is also maintained.

[0027] The present invention is not limited to the aforementioned embodiments and can include other embodiments.

[0028] For example, in the case mentioned above, a fuel cut valve is joined to the fuel tank; however, an on-board refueling vapor recovery valve or another valve that can be assembled to the fuel tank may be used instead.

[0029] The present invention is not limited to the joining of a fuel tank and a mounting member, and can include a joining structure of plastic pipes.

[0030] In addition to the aforementioned embodiments, the present invention can be also be structured as shown in Figs. 3A and 3B.

[0031] Namely, as shown in Figs. 3A and 3B, a recessed portion 34A or a protruding portion 34B is provided on a plastic part on one side. The recessed portion 34A or protruding portion 34B is joined to the metamorphic polyethylene layer 33 (by insert molding or the like) to improve the joining property and airtightness. At the same time, the performance for preventing the part from coming off can be improved. The number of recessed portions 34A or protruding portions 34B is not determined in particular, that is, the recessed portion 34A or protruding portion 34B may be a single circular groove (or a projection) or a plurality of circular grooves (or projections). As for the shape of the projection, in addition to a rectangular shape or saw tooth shown in the figures, various other shapes may be employed. Furthermore, the recessed portion 34A or protruding portion 34B may be made a groove or projection formed at an area (locally) rather than an elongated circular groove or projection.

[0032] As shown in Fig. 4, a stopper 35 may be provided to the plastic part on the one side (the flange portion 32A of the fuel cut valve 32) to extend toward the plastic part on the other side (the fuel tank 31). By abutting the stopper 35 against the plastic part on the other side (the fuel tank 31), indexing of the joined position when joined is made easier, thus joining operation becomes easier.

[0033] Furthermore, as shown in Fig. 5, a recessed-protruding portion 36 may be provided on the plastic part

on the other side (the mounting member 31A of the fuel tank 31) or the metamorphic polyethylene layer 33. By joining the recessed-protruding portion 36 at an area (by insert molding or the like), the joining property and airtightness can be improved together with the performance for preventing the part from coming off. In this case as well, the number of the recessed-protruding portions 36 is not determined in particular. For example, the recessed-protruding portion 36 may be a single circular groove (or a projection) or a plurality of circular grooves (or projections). As for the shape of the projection, various shapes may be employed, such as a saw-tooth shaped projection, in addition to the rectangular projection or groove as shown in the figure. Furthermore, the recessed-protruding portion 36 may be made a groove or projection formed at an area (locally) rather than an elongated circular groove or projection.

#### Claims

1. A joining structure **characterized by** comprising:
  - a first plastic part (21) composed of at least one thermoplastic resin of polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide (PPS);
  - a second plastic part (22) composed of at least high-density polyethylene (HDPE); and
  - a metamorphic polyethylene layer (23) that comes in contact with both the first plastic part (21) and the second plastic part (22), for joining the first plastic part (21) and the second plastic part (22).
2. A joining structure according to claim 1, **characterized in that**
  - the first plastic part (21) is composed of a reinforced thermoplastic resin.
3. A joining structure according to claim 1 or 2, **characterized in that**
  - the metamorphic polyethylene layer (23) is interposed between the first plastic part (21) and the second plastic part (22).
4. A joining structure according to any one of claims 1 to 3, **characterized in that**
  - the first plastic part (21) is at least a part of a fuel cutoff valve casing, and the second plastic part (22) is at least a part of a mounting portion of a plastic fuel tank.
5. A joining structure according to any one of claims 1 to 3, **characterized in that**
  - the first plastic part (21) is at least a part of an onboard refueling vapor recovery valve casing, and

the second plastic part (22) is at least a part of the mounting portion of a plastic fuel tank.

6. A joining structure according to any one of claims 1 to 5, **characterized in that**

the first plastic part (21) has at least one of either a recessed portion (34A) or a protruding portion (34B), and the metamorphic polyethylene layer (23) has at least one of either a recessed portion or a protruding portion to engage with at least one of either the recessed portion (34A) or the protruding portion (34B) provided on the first plastic part (21).

7. A joining structure according to any one of claims 1 to 5, **characterized in that**

the second plastic part (22) has at least one of either a recessed portion or a protruding portion (36), and the metamorphic polyethylene layer (23) has at least one of either a recessed portion or a protruding portion to engage with at least one of either the recessed portion or the protruding portion (36) provided on the second plastic part (22).

8. A joining structure according to any one of claims 1 to 7, **characterized in that**

the first plastic part (21) has a stopper (35) extending toward the second plastic part (22), and the end portion of the stopper (35) abuts against the second plastic part (22) upon joining of the first plastic part (21) and the second plastic part (22).

FIG. 1A

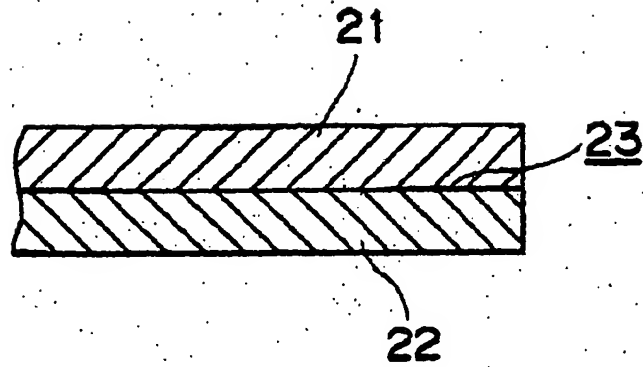


FIG. 1B

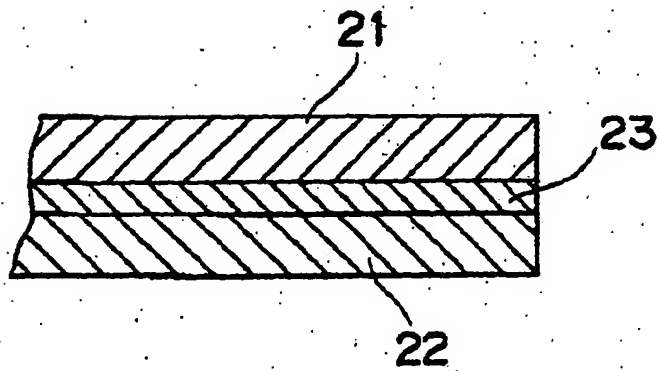
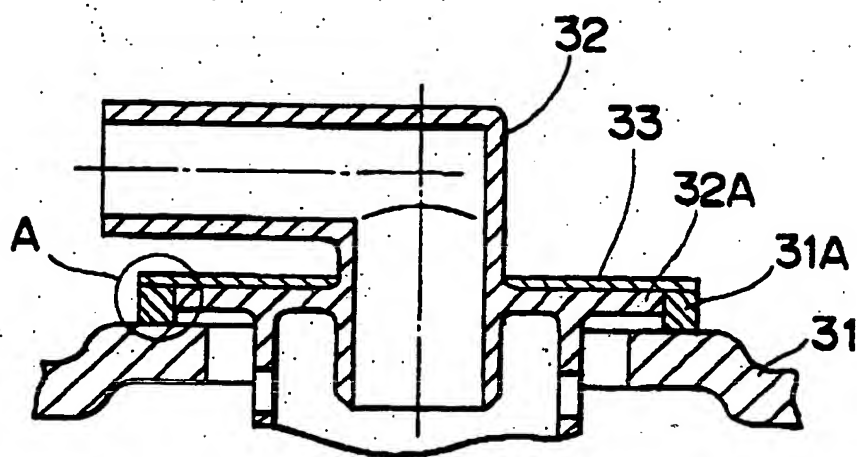
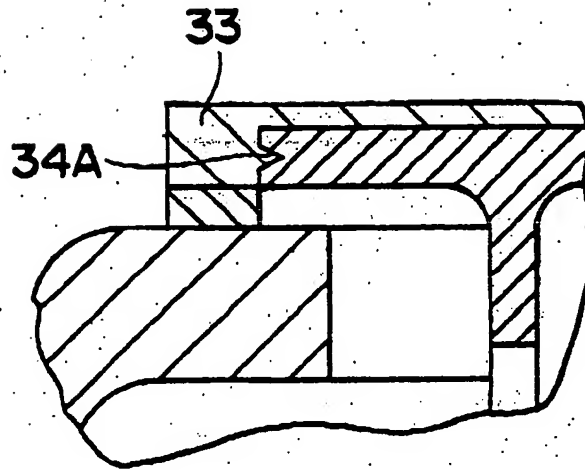


FIG. 2



**FIG. 3A**



**FIG. 3B**

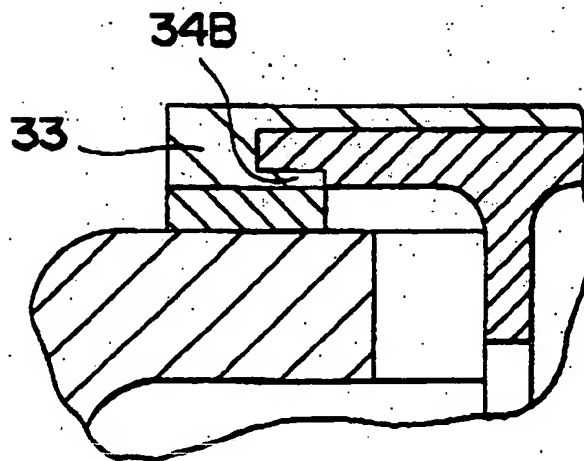


FIG. 4

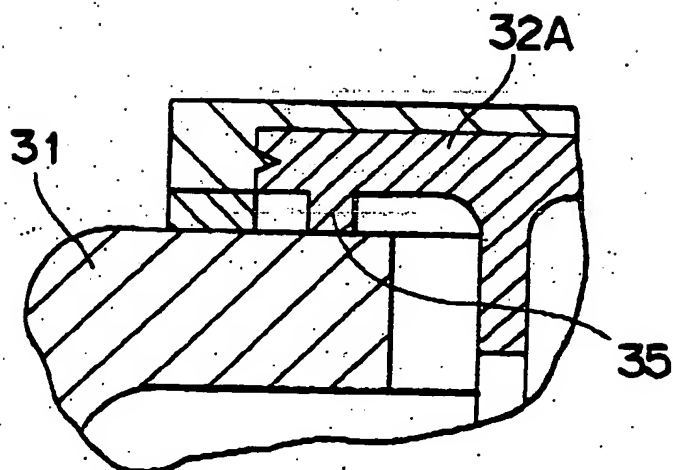
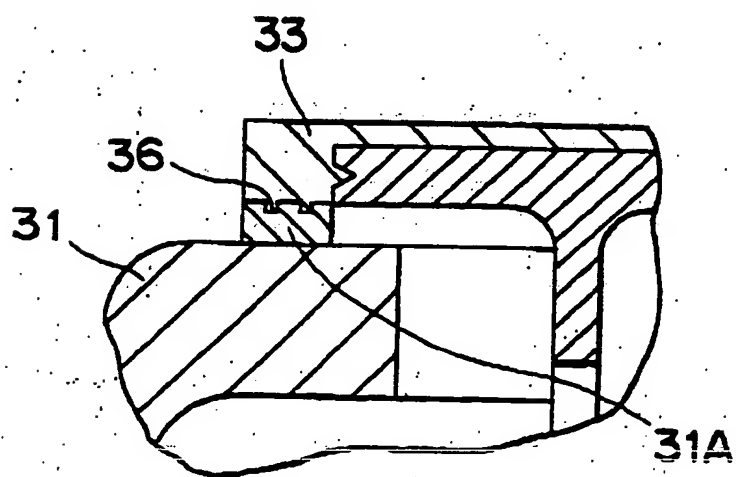
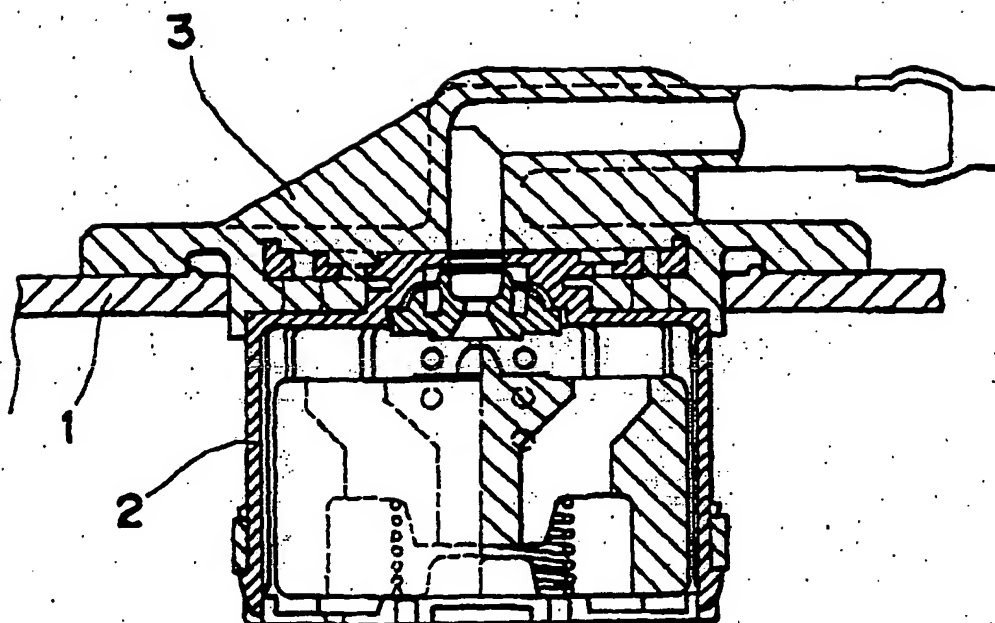


FIG. 5

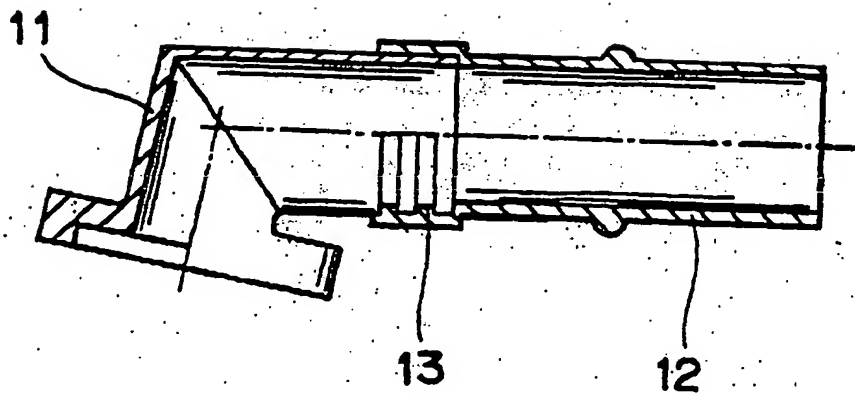


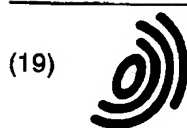


**FIG. 6**  
Related Art



**FIG. 7**  
Related Art





Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) **EP 1 142 935 A3**

(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:  
15.05.2002 Bulletin 2002/20

(51) Int Cl.7: **C08J 5/12, C09J 123/06,  
C09K 3/10, B60K 15/03  
// B60K15/01**

(43) Date of publication A2:  
10.10.2001 Bulletin 2001/41

(21) Application number: **01108729.3**

(22) Date of filing: **06.04.2001**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE TR**  
Designated Extension States:  
**AL LT LV MK RO SI**

(72) Inventors:  
• Muto, Nobuharu  
Sowa-machi, Sashima-gun, Ibaraki-pref306 (JP)  
• Osaki, Hiroshi  
Sowa-machi, Sashima-gun, Ibaraki-pref306 (JP)

(30) Priority: **07.04.2000 JP 2000106957**

(74) Representative:  
Winter, Brandl, Fűriss, Hübner, Röss, Kaiser,  
Polte Partnerschaft  
Patent- und Rechtsanwaltskanzlei  
Alois-Steinecker-Strasse 22  
85354 Freising (DE)

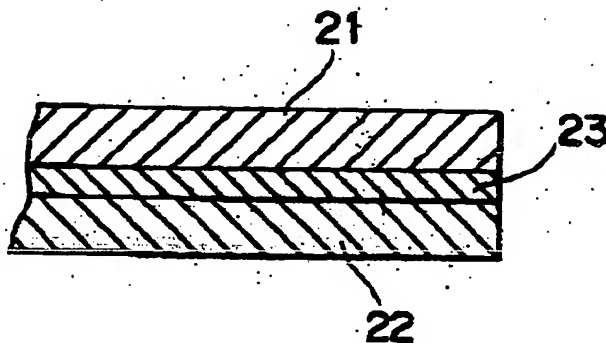
(71) Applicant: **Kyosan Denki Co., Ltd.**  
Sashima-gun, Ibaraki-pref., 306-0206 (JP)

(54) **Plastic parts joining structure**

(57) In a structure for joining a first plastic part and a second plastic part, the first plastic part (21) is composed of at least one resin such as polyamide (PA), polybutylene terephthalate (PBT), polyacetal (POM), polyethylene terephthalate (PET), or polyphenylene sulfide

(PPS), while the second plastic part (22) is composed of high-density polyethylene (HDPE). Between the two parts (21, 22), a metamorphic polyethylene layer (23) exhibiting a good joining property for both the first and second plastic parts (21, 22) is interposed to join the parts.

**FIG. 1B**





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 01 10 8729

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 195 35 413 C (RASMUSSEN GMBH) 2 October 1996 (1996-10-02) * column 2, line 40 - column 3, line 16 *	1-8	C08J5/12 C09J123/06 C09K3/10 B60K15/03 //B60K15/01
A	EP 0 626 256 A (MITSUBISHI PETROCHEMICAL CO) 30 November 1994 (1994-11-30) * page 1, line 14 - page 2, line 8; claim 1 *	1-8	
A	DE 35 24 881 A (ELKAMET WERK) 22 January 1987 (1987-01-22) * column 3, line 23 - line 35; claim 3 *	1-8	
A	US 5 424 020 A (MATUBARA SHIGEYOSHI ET AL) 13 June 1995 (1995-06-13) * column 2, line 17 - line 38 * * column 5, line 1 - line 24; figures 3,4 *	1-8	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			C08J C09J C09K B60K
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 20 March 2002	Examiner Kiebooms, R
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention F : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 10 8729

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-03-2002

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
DE 19535413	C	02-10-1996	DE	19535413 C1	02-10-1996
EP 0626256	A	30-11-1994	DE	69404755 D1	11-09-1997
			DE	69404755 T2	22-01-1998
			EP	0626256 A1	30-11-1994
			JP	7040517 A	10-02-1995
			US	5443874 A	22-08-1995
DE 3524881	A	22-01-1987	DE	3524881 A1	22-01-1987
US 5424020	A	13-06-1995	JP	2850392 B2	27-01-1999
			JP	3076614 A	02-04-1991
			JP	2917372 B2	12-07-1999
			JP	3261519 A	21-11-1991
			CA	2039160 A1	22-02-1991
			DE	69021361 D1	07-09-1995
			DE	69021361 T2	29-02-1996
			EP	0439625 A1	07-08-1991
			ES	2077684 T3	01-12-1995
			WO	9102639 A1	07-03-1991
			KR	181510 B1	15-05-1999
			US	5275776 A	04-01-1994
			CA	2027741 A1	17-04-1991
			EP	0423676 A2	24-04-1991

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**